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Educational Writings

REVIEWS AND BOOK NOTES

Arithmetic and the "new psychology."—The literature on the psychology of elementary-school subjects has been increased by the recent publication of a book on arithmetic by Professor Thorndike.[1] This book is the author's definition of arithmetic in terms of the "new psychology" and a body of inferences from the same psychology in regard to the best methods of teaching and learning the subject. Some conclusions are drawn from direct experimental comparisons of methods of learning, but for the most part the practical conclusions are deduced from general psychological principles. Among these psychological principles the most general and prominent is the "bond" conception. In the author's view learning consists of the formation of bonds or connections between situations and responses. These bonds can be analyzed into groups of very minute and simple connections, and a complex activity is simply a collection of a large number of elementary bonds. The bond which constitutes an action is strengthened in proportion as the action is satisfying. The higher mental processes are reducible to exactly the same kind of bonds as the simplest motor responses and "habit rules in the realm of thought as truly and as fully as in the realm of action." There is, therefore, no fundamental distinction between reasoning, analysis, abstraction, etc., and acts of skill. The book is an exposition of arithmetic in these terms and on the assumption of these principles.

The exposition opens with a discussion of the nature of arithmetical abilities. Four theories are discussed: the *series* meaning advanced by Phillips, the *collection* meaning emphasized in ordinary school practice, the *ratio* meaning emphasized by McLellan and Dewey, and Speer and Grube's *relational* meaning. The author judiciously refuses to identify the psychology of number exclusively with any one of these meanings but concludes that each is a correct, though partial, description of the facts and should be represented in teaching practice.

The constitution of arithmetical abilities is introduced by an account of the measurement of abilities by means of tests. Here the author takes the position that tests not only measure abilities but define them. It is true that the scores of a test define the abilities *which are measured by the test*, but they define arithmetical abilities in general only in so far as the test is correctly designed in the first place. This means that the abilities must be defined before the test is constructed. Thorndike illustrates this by the question whether reasoning tests should include *described* problems as distinguished from *real* problems. It is clear that this question is not answered by the tests themselves but by an analysis of the value of these two types of problems.

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[1] EDWARD L. THORNDIKE, *The Psychology of Arithmetic*. New York: Macmillan Co., 1922. Pp. xvi+314.

The author does not attempt a detailed catalogue of arithmetical abilities. He illustrates them by the case of fractions and then passes to the discussion of certain general principles. Among these a few may be mentioned for illustration. On the basis of his critical psychological insight, observation, and, in some cases, experiment, Thorndike gives a list of habits which should be formed but are now neglected, and others which are formed but are either useless or harmful. He follows this with a discussion of the amount of strength which the various bonds should have and the amount of practice which is necessary to bring them to this strength. There is considerable speculation regarding the amount of practice which should be given to various operations. The reviewer believes that a much surer way to determine the requisite amount of practice is to continue it until a specific test score is reached.

Considerable emphasis is laid on the desirability of the inductive rather than the deductive method. The principle laid down is that the child should not be given a general definition or explanation of an operation, but should be told specifically, in detail, and without any explanation, the steps to follow. From this purely imitative procedure the child may be expected to infer the definition, law, or rule in so far as it is profitable for him to do so. It is misleading to imply that this latter procedure is the only alternative to the former. We may agree that the pupil should begin with concrete experience and with problems rather than with general definitions or explanations. Instances are at hand, however, to prove that pupils can proceed in a much more open-eyed fashion to a recognition of the rules or principles, even to the extent of anticipating an operation before it is either explained or dictated to them. The remainder of the volume is a rather general account of such matters as the psychology of thinking, instinctive dispositions, interest in arithmetic, the conditions of learning, and individual differences. Under "The Conditions of Learning" is given a very useful discussion of good and bad types of textbook material from the point of view of ease of perception.

The book is, of course, a valuable contribution to the literature of educational psychology. It offers many observations which will be very useful with reference to the curriculum and methods of teaching. To the reviewer it seems that the bond theory is overdone. It is a new mental atomism in which the elements are stimulus-response units instead of sensations. The theory provides no cement by which the bonds may be united to explain the process of organization of thought. The constant use of the "bond" terminology also renders the style heavy and at times obscure. These are blemishes in a book which on the whole constitutes an important contribution.

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